

SKiM® 4

IGBT Modules

SKiM401MLI07E4

Features

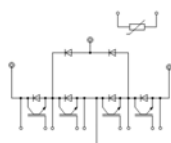
- IGBT 4 Trench Gate Technology
- Solder technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Isolated by Al_2O_3 DCB (Direct Copper Bonded) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor

Typical Applications*

- UPS
- 3 Level Inverter

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max, recommended $T_{op} = -40 \dots +150^\circ\text{C}$



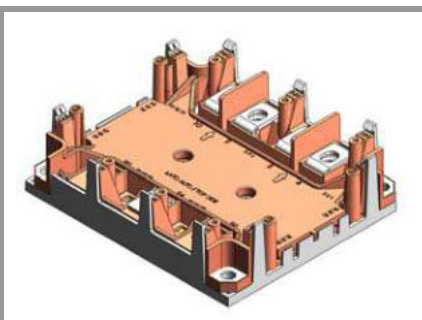
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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}		650	V
I_C	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$ $T_s = 70^\circ\text{C}$	A A
I_{Cnom}		400	A
I_{CRM}	$I_{CRM} = 2 \times I_{Cnom}$	800	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 360\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 650\text{ V}$	$T_j = 150^\circ\text{C}$	6 μs
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
I_F	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$ $T_s = 70^\circ\text{C}$	266 205 A A
I_{Fnom}		400	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	800	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	2160	A
T_j		-40 ... 175	$^\circ\text{C}$
Clamping diode			
I_F	$T_j = 175^\circ\text{C}$	$T_s = 25^\circ\text{C}$ $T_s = 70^\circ\text{C}$	266 205 A A
I_{Fnom}		300	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	600	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	2160	A
T_j		-40 ... 175	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$	400	A
T_{stg}		-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	2500	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.45 1.70	1.85 2.10	V V
V_{CE0}		$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	0.9 0.85	1 0.9	V V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.4 2.1	2.1 3.0	$\text{m}\Omega$ $\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 6.4\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 650\text{ V}$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$			mA mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	24.67		nF
C_{oes}		$f = 1\text{ MHz}$	1.54		nF
C_{res}		$f = 1\text{ MHz}$	0.73		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		3200		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.0		Ω



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Typical Applications*

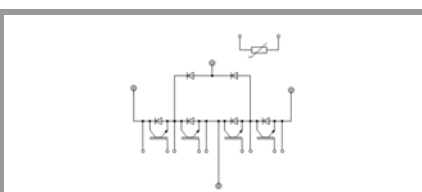
- UPS
- 3 Level Inverter

Remarks

- Case temperature limited to $T_C = 125^\circ\text{C}$ max, recommended $T_{op} = -40 \dots +150^\circ\text{C}$

Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
$t_{d(on)}$	$V_{CE} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		149.14	ns
t_r	$I_C = 400\text{ A}$	$T_j = 150^\circ\text{C}$		79.7	ns
E_{on}	$R_{G\ on} = 2\ \Omega$	$T_j = 150^\circ\text{C}$		3.32	mJ
$t_{d(off)}$	$R_{G\ off} = 2\ \Omega$	$T_j = 150^\circ\text{C}$		420	ns
t_f	$di/dt_{on} = 1112\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		180	ns
E_{off}	$di/dt_{off} = 3801\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		20.91	mJ
$R_{th(j-s)}$				0.25	K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		1.5	1.9	V
	V _{GE} = 0 V chipelevel	T _j = 150 °C		1.6	2.0	V
V _{F0}		T _j = 25 °C	0.95	1.04	1.236	V
		T _j = 150 °C		0.85	0.99	V
r _F		T _j = 25 °C	0.8	1.2	1.8	mΩ
		T _j = 150 °C		1.8	2.6	mΩ
I _{RRM}	V _{GE} = -15 V V _R = 300 V					A
Q _{rr}				24		μC
E _{rr}						mJ
R _{th(j-s)}	per diode			0.35		K/W
Clamping diode						
V _F = V _{EC}	I _F = 300 A	T _j = 25 °C		1.4	1.8	V
	V _{GE} = 0 V chipelevel	T _j = 150 °C		1.4	1.8	V
V _{F0}		T _j = 25 °C	0.95	1.04	1.236	V
		T _j = 150 °C		0.85	0.99	V
r _F		T _j = 25 °C	0.8	1.2	1.8	mΩ
		T _j = 150 °C		1.8	2.6	mΩ
I _{RRM}	V _{GE} = -15 V V _R = 300 V			127		A
Q _{rr}						μC
E _{rr}				1.8		mJ
R _{th(j-s)}	per diode			0.35		K/W
Module						
L _{CE}				22		nH
R _{CC'+EE'}	terminal-chip	T _s = 25 °C		1.35		mΩ
		T _s = 125 °C		1.75		mΩ
M _s	to heat sink (M5)		2		3	Nm
M _t	to terminals M6		4		5	Nm
w				317		g
Temperature Sensor						
R ₁₀₀	T _c =100°C (R ₂₅ =5 kΩ)			493 ± 5%		Ω
B _{100/125}	R(T)=R ₁₀₀ exp[B _{100/125} (1/T-1/T ₁₀₀)]; T[K];			3550 ±2%		K



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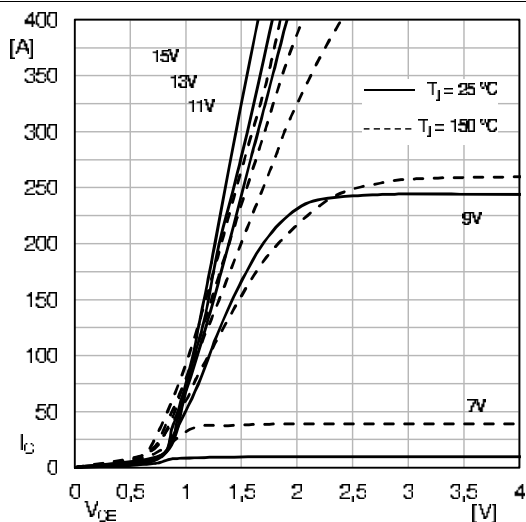


Fig. 3: Typ. IGBT output characteristic, inclusive $R_{CC} + E_E$

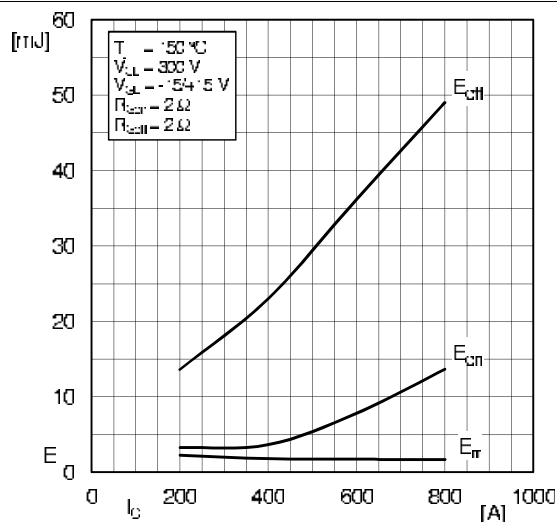


Fig. 6: Typ. turn-on /-off energy = $f(I_C)$

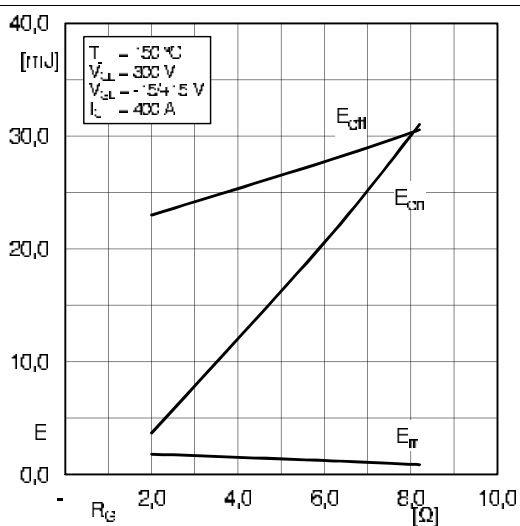


Fig. 8: Typ. turn-on /-off energy = $f(R_G)$

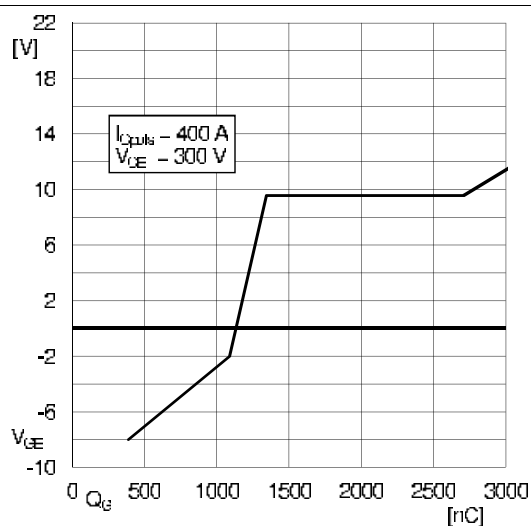


Fig. 10: Gate charge characteristic

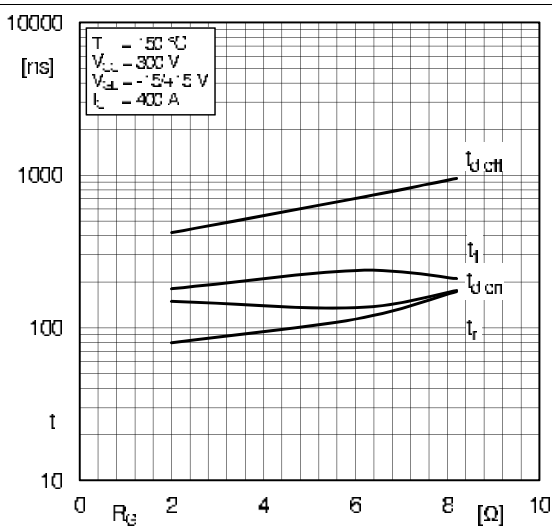


Fig. 12: Typ. switching times vs. gate resistor R_G

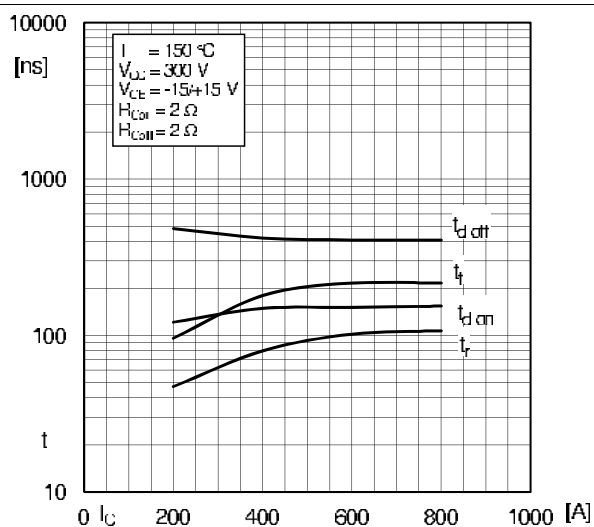
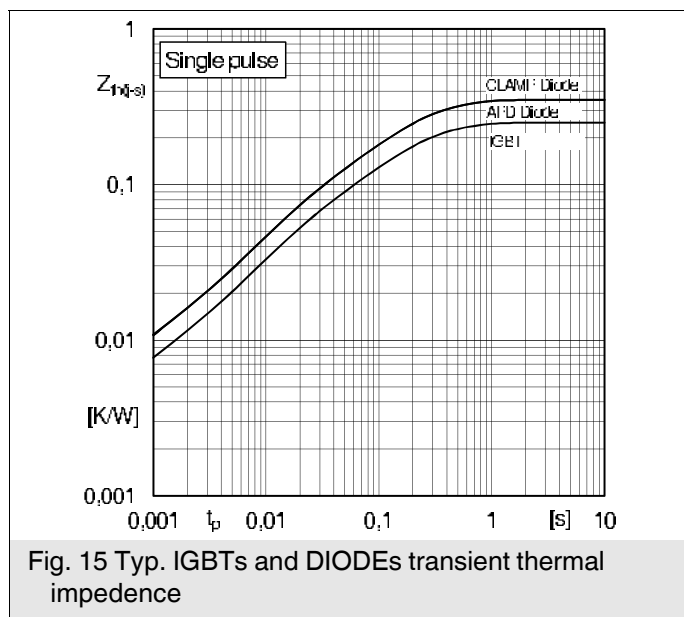
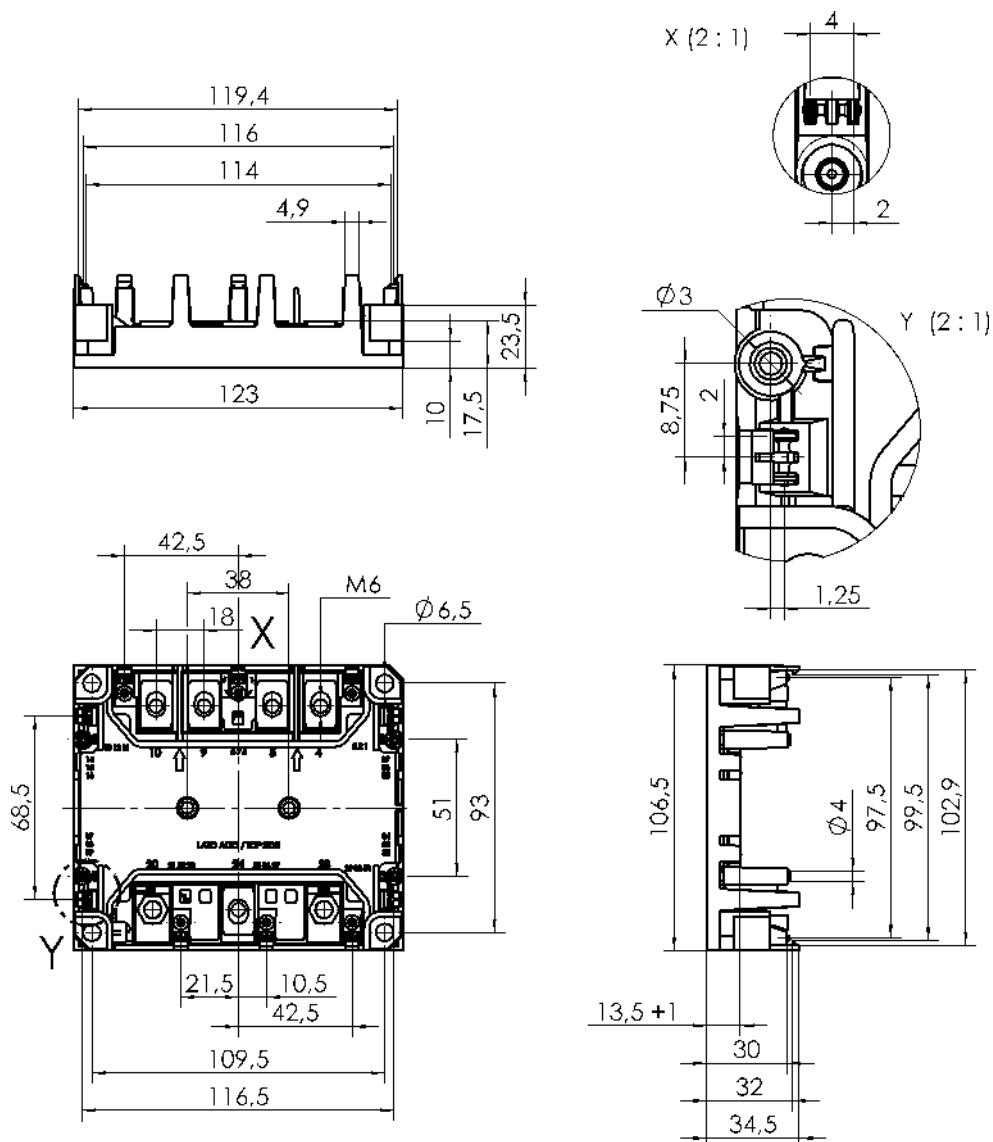
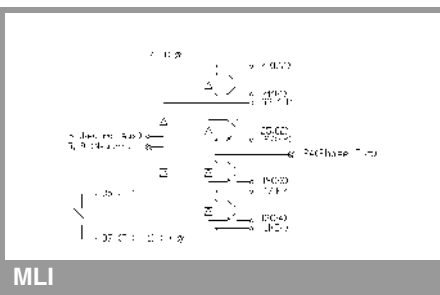


Fig. 14: Typ. switching times vs. I_C





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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.